Milken Institute School of Public Health THE GEORGE WASHINGTON UNIVERSITY	**BS HDS/MS HDS Dual Degree** **Program 2024-2025** Note: All curriculum revisions will be updated immediately on the website http://www.publichealth.gwu.edu

Program Director	Undergraduate Program Advisor

BACKGROUND:

The George Washington University Milken Institute School of Public Health (SPH) offers a unique opportunity to students interested in public health and biomedical research. To further effectively train a workforce in public health and related fields with strong data science and data analytics skills, we have developed a dual degree program for students to earn both a BS and MS degree. This dual degree program focuses on GW undergraduates already in our Bachelor's Degree program in Health Data Science (BS HDS) with an interest in adding more health data science expertise to their existing skillsets. This program would result in the earning of a BS degree and MS degree in Health Data Science (BS HDS/MS HDS program). The program is designed for George Washington University residential undergraduates.

BS HDS/MS HDS program

The Milken Institute SPH will accept outstanding students each year to the BS in Health Data Science /MS Health Data Science program (BS HDS/MS HDS). As incentives to move beyond the traditional undergraduate curriculum, SPH offers participants admission to the MS HDS program without having to sit for the Graduate Record Examination (GRE), as well as the opportunity to complete both the BS and MS degrees more efficiently than if the degrees been completed separately. The BS HDS/MS HDS program is a multi-level, dual-degree program, meaning that students are concurrently enrolled in one undergraduate program and one graduate program, and that degrees will be awarded in different semesters with some undergraduate work counting towards the graduate degree.

Mission

The mission of this program is to train the next generation of leaders and practitioners in public health, medicine, and data analytics. Students in the program develop practical skills for innovative data analysis and will be trained in becoming excellent communicators of scientific findings in public health and biomedical research. The program takes advantage of the rich biostatistical and bioinformatics resources at GWU and in the Nation's Capital and is designed to prepare students to be independent practitioners and collaborators in interdisciplinary research.

Prerequisites

All applicants to the dual BS HDS/MS HDS program must have completed the following prerequisites with a grade of B or better to be considered for admission:

Biostatistics Concentration	_Bioinformatics Concentration_
Minimum Pre-requisite • Calculus I and II (GW equivalent is MATH 1231 and 1232) • Undergraduate Statistics (GW equivalent is PUBH 2142 or STAT 1051) Full Pre-requisite (in addition to above) • Calculus III (GW equivalent is MATH 2233) • Linear Algebra (GW equivalent is MATH 2184)	• a course in undergraduate statistics • a course in undergraduate biology • a course in undergraduate computer science

Competencies

Upon completion of the dual BS HDS/MS HDS program students will possess the following competencies.

Biostatistics Concentration Competencies:
1. **Statistical Programming**: Use statistical software to perform programming tasks for the purposes of statistical analysis of public health and biomedical data.
2. **Biostatistical Methodology**: Summarize and evaluate biostatistical methodology applied in public health and biomedical research.
3. **Communication**: Communicate principles of statistical theory and study design to interprofessional team members.
4. **Applied Statistics**: Apply the principles of biostatistical methodology to perform analyses of public health and biomedical data.
5. **Scientific Writing**: Develop components of the statistical analysis section of public health and biomedical research proposals.

Bioinformatics Concentration Competencies:
1. **Programming:** Develop skills in programming, data structures, algorithms, machine learning, high-performance computing and apply these skills to create approaches that facilitate biological data analysis.
2. **Biology:** Develop a basis of knowledge in biology and evaluate biological data generation technologies.
3. **Statistics:** Apply statistical research methods in the context of molecular biology, genomics, medical, and population genetics research.
4. **Foundational Knowledge:** Interpret and synthesize the various foundational concepts of bioinformatics, including genomics, algorithms, and other key tools used in bioinformatics.
5. **Conceptual Integration:** Integrate concepts and data across fields of computer science, statistics, data science, biology, and health sciences through bioinformatics.

BS HDS/MS HDS GRADUATION REQUIREMENTS

1. **Total Credit Requirement**. 120 credits are required for the BS HDS degree, which includes 9 crossover credits from the MS HDS program. An additional 27 graduate credits are required for the MS degree.
2. **Course Requirements**. Successful completion of the undergraduate BS HDS program and completion of the MS HDS program is required for the dual BS HDS/MS HDS degree.

3. **Master's Thesis or Research Report**: Successful defense of a Master's Thesis or presentation of a Research Report.
4. **Grade point average**: A minimum overall grade-point average of B (3.0) for the MS HDS.
5. **Time Limit Requirement**: The degree must be completed within 10 years.
6. **Pathways to Public Health**. Must be successfully completed unless waiver received.
7. **Ethics/Professional Skills Requirement:** Participate in department-led ethical and professional skills training.
8. **Professional Enhancement requirement**: Students must participate in 8 hours per degree program of advisor pre-approved Public Health-related lectures, seminars, symposia and/or conferences related to the appropriate field of study specifically focused on research and research ethics. Students must submit documentation of Professional Enhancement activities to the SPH Office of Student Records. Instructions can be found here: https://publichealth.gwu.edu/academics/forms
9. **CITI Training requirement**: All students are required to complete training regarding human subject protection regulation and the Health Insurance Portability and Accountability Act of 1996 (HIPAA). To fulfill this requirement, you must complete the Collaborative IRB Training Initiative (CITI) Course in The Protection of Human Research Subjects.
10. **Integrity Quiz & Plagiarism Requirement**: All students are required to review the George Washington University Code of Academic Integrity and take the quiz within their first semester of study. The Code of Integrity and step-by-step instructions can be found here: http://publichealth.gwu.edu/integrity

BS HDS / MS HDS Credit Distribution Chart	
Category	**Credits**
BS General Education	22-23
BS Health Data Science Core	56-57
BS Health Data Science Electives (pre-approved or approved by advisor)	10
BS General Electives (to be chosen with advisor)	31-32
BS Total Credits (includes 9 crossover credits from the MS HDS program)	120
MS HDS Additional Credits	27
BS HDS/MS HDS Total Credits (120 BS HDS credits + 27 MS HDS credits = 147 total credits	**147**

Undergraduate courses for the BS HDS (120 credits)
Follow requirements as indicated in the BS HDS program except for the substitution of crossover credits

Graduate courses for the MS HDS – Bioinformatics Concentration (36 total credits including 9 crossover credits)		
PUBH 6850	1	Introduction to SAS for Public Health Research
PUBH 6851	1	Introduction to R for Public Health Research
PUBH 6852	1	Introduction to Python for Public Health Research
PUBH 6080	0	Pathways to Public Health
PUBH 6860	3	Principles of Bioinformatics

PUBH 6854	3	Applied Computing in Health Data Science
PUBH 6859	3	High Performance and Cloud Computing
PUBH 6861	3	Public Health Genomics
PUBH 6884	3	Bioinformatics Algorithms and Data Structures
PUBH 8870	3	Statistical Inference for Public Health Research I
PUBH 8885	3	Computational Biology
PUBH 6886	3	Statistical and Machine Learning for Public Health Research
PUBH 68xx	6	Electives
PUBH 6897	2	Research in Biostatistics and Bioinformatics
PUBH 6898	1	Master of Science Thesis
Total graduate credits	**36 credits**	

Graduate Substitutions/Crossover courses in the MS HDS Program (9 crossover credits)
Students take the MS course listed instead of the BS Course

MS HDS Course	Credits	BS HDS Course Title/Explanation for Substitution
PUBH 6854 Applied Computing in Health Data Science	3	Replaces PUBH 4201: Practical Computing OR CSCI 1011: Introduction to Programming with Java OR CSCI 1012 Introduction to Programming with Python
PUBH 6884 Bioinformatics Algorithms and Data Structures	3	Replaces PUBH 4202: Bioinformatics Algorithms and Data Structures OR CSCI 1112: Algorithms and Data Structures
Take one of: a) PUBH 6860: Principles of Bioinformatic OR b) PUBH 6861: Public Health Genomics OR c) PUBH 6886: Statistical and Machine Learning for Public Health Research	3	Replaces one of the following approved HDS Electives: a) PUBH 3201: Introduction to Bioinformatics OR b) PUBH 3202: Introduction to Genomics OR c) CSCI 4364: Machine Learning
	9	**Total Crossover Credits**

Graduate courses for the MS HDS – Biostatistics Concentration
(36 total credits including 9 crossover credits)

PUBH 6850	1	Introduction to SAS for Public Health Research
PUBH 6851	1	Introduction to R for Public Health Research
PUBH 6852	1	Introduction to Python for Public Health Research

PUBH 6080	0	Pathways to Public Health
PUBH 6860	3	Principles of Bioinformatics
PUBH 6862	3	Applied Linear Regression for Public Health Research
PUBH 6864	3	Applied Survival Analysis for Public Health Research
PUBH 6865	3	Applied Categorical Data Analysis for Public Health Research
PUBH 6866	3	Principles of Clinical Trials
PUBH 6869	1	Principles of Biostatistical Consulting
PUBH 8870	3	Statistical Inference for Public Health Research I
PUBH 8871	3	Statistical Inference for Public Health Research II
PUBH 6887	3	Applied Longitudinal Data Analysis for Public Health Research
PUBH 68xx	7	Electives
PUBH 6898	1	Master of Science Thesis
Total graduate credits	**36 credits**	

Graduate Substitutions/Crossover Courses in the MS HDS Program (9 crossover credits)		
Students take the MS course listed instead of the BS Course		
MS HDS Course	**Credits**	**BS HDS Course Title/Explanation for Substitution**
PUBH 6862 Applied Linear Regression for Public Health Research OR PUBH 6865 Applied Categorical Data Analysis for Public Health Research	3	Replaces STAT 2118 or STAT 2183: Regression Analysis OR Applied Statistical Methods
PUBH 6860: Principles of Bioinformatics	3	Replaces PUBH 3201: Introduction to Bioinformatics
Take one approved MS-HDS elective for Biostatistics concentration (contact advisor for approval)	3	Replaces one BS-HDS elective course (contact advisor for approval)
	9	**Total Crossover Credits**